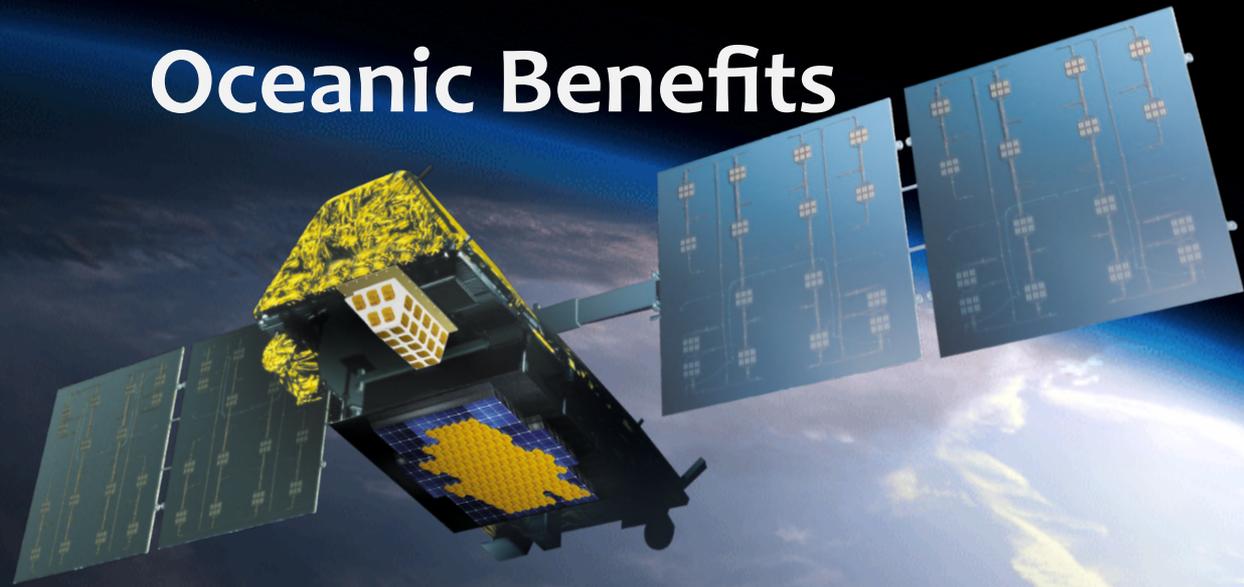


Space-Based ADS-B Review of Gander-Shanwick Oceanic Benefits



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NAV CANADA - Ottawa
February 2014

ADS-B Benefits Assessment Scope

We assessed the operational impact of reducing separation minima to 15nm longitudinally and $\frac{1}{2}$ a degree laterally (~30nm) in the Gander-Shanwick oceanic airspace.

Base Case and Option Case Characteristics

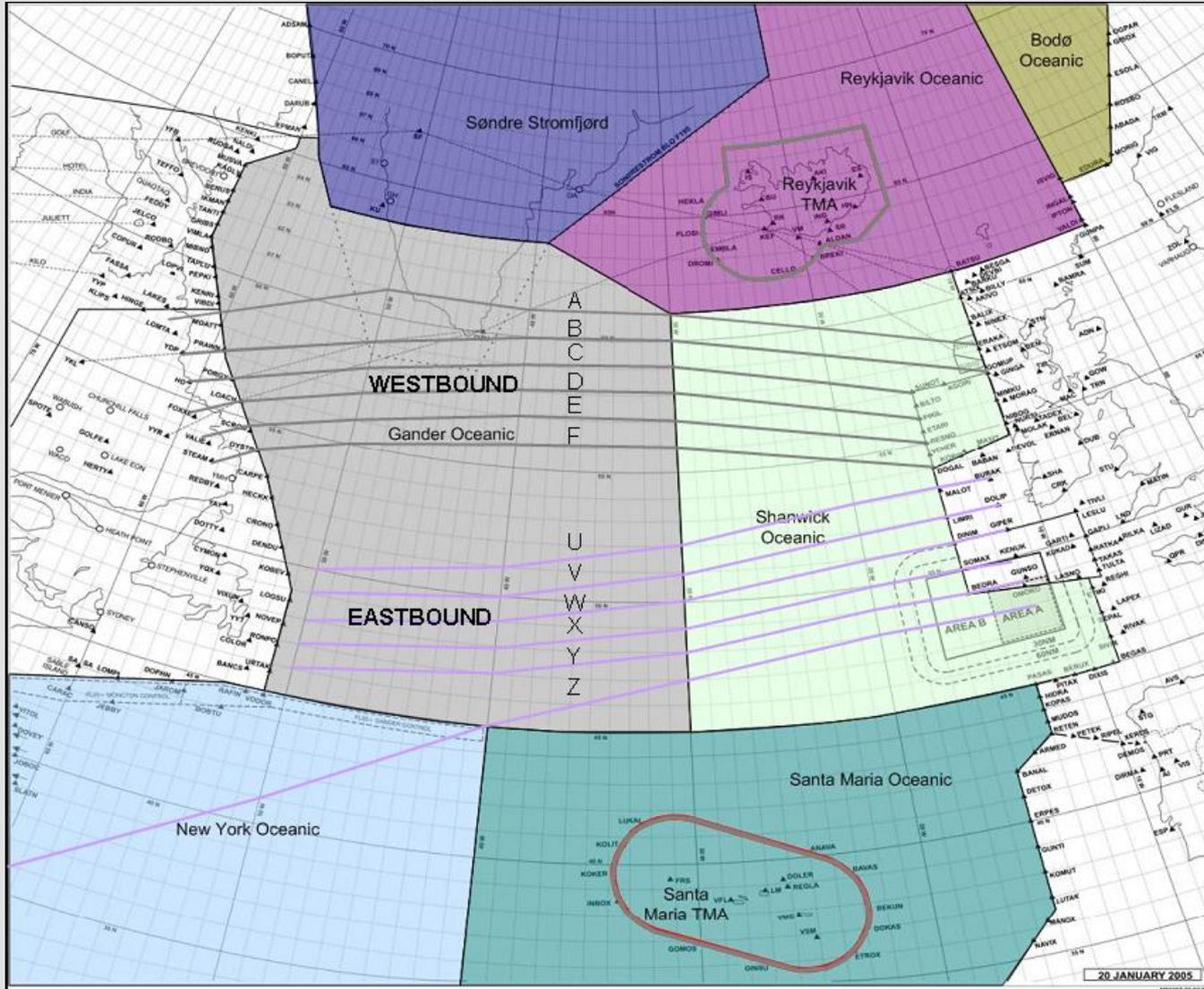
Characteristic	Base Case			ADS-B Option Case
	Current	RLong	RLat	
Lateral Separation	60 nm (1°)	N/A	30 nm (1/2°)	30 nm (1/2°)
Longitudinal Separation	10 min or ~80 nm	5 min or ~40 nm	N/A	15 nm
Surveillance	Way Point Report (WPR)	ADS-C	ADS-C	ADS-B (1090ES out)
Communication	HF Voice and CPDLC	CPDLC	CPDLC	CPDLC
Distance Verification	Every 10° Long (~50 mins)	Every 18 minutes	Not Determined	Targets on Display
RNP/RNAV Type	RNP 12.6 (MNPS)	RNP 12.6 (MNPS)	RNP 4	N/A
Conflict Prediction?	Yes	Yes	Yes	Yes
Benefits Start Year	N/A	2013/14	P1: 2015	2018
Aircraft Capable 2012 (Dec)	All are Capable	67%	67%	47% (certified)
2015		80%	80%	90%
2018		100%	100%	90%

Traffic Between North America & Europe Daily





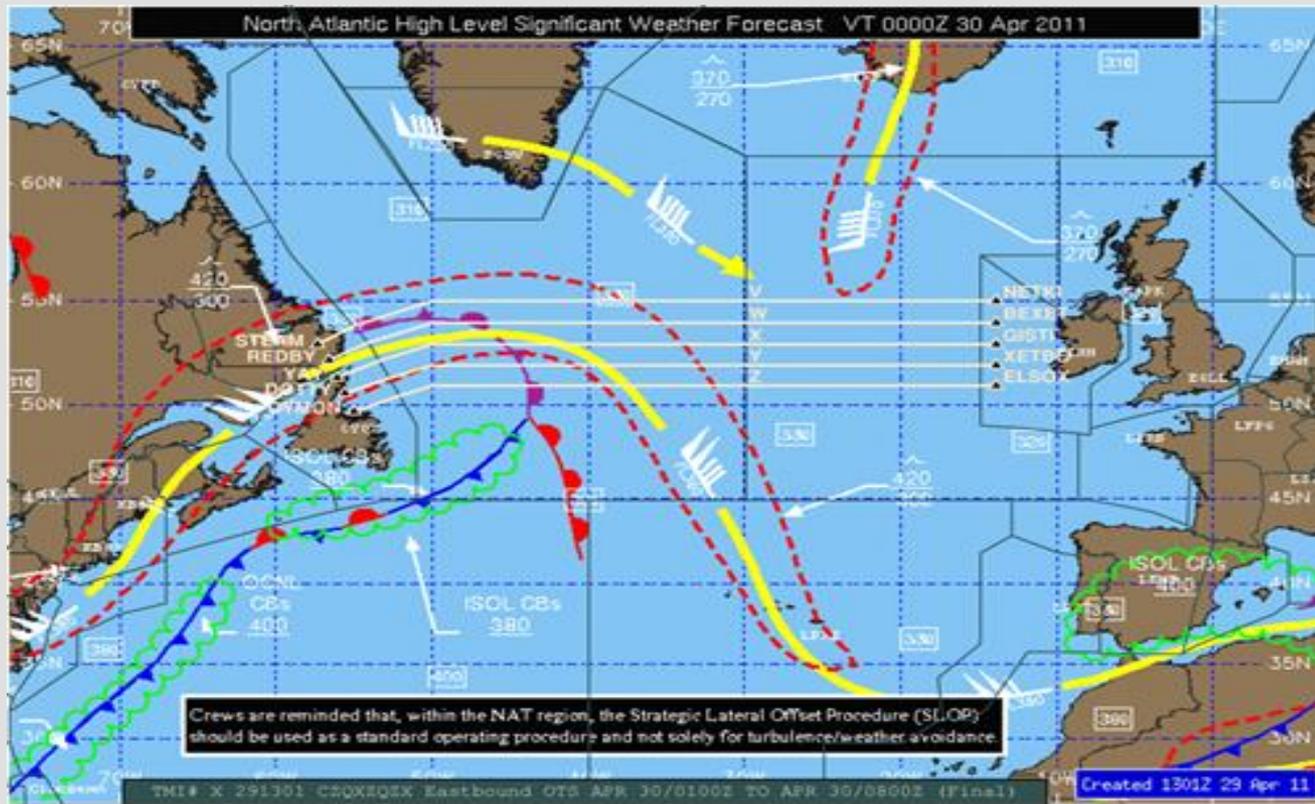
NAT Airspace + Equipage



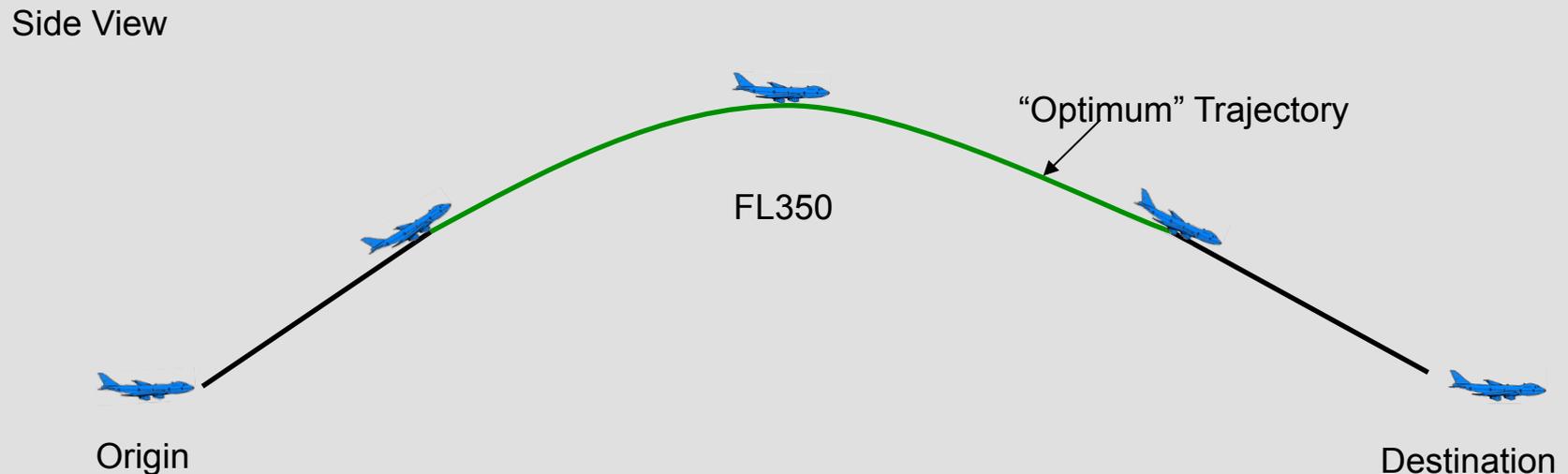
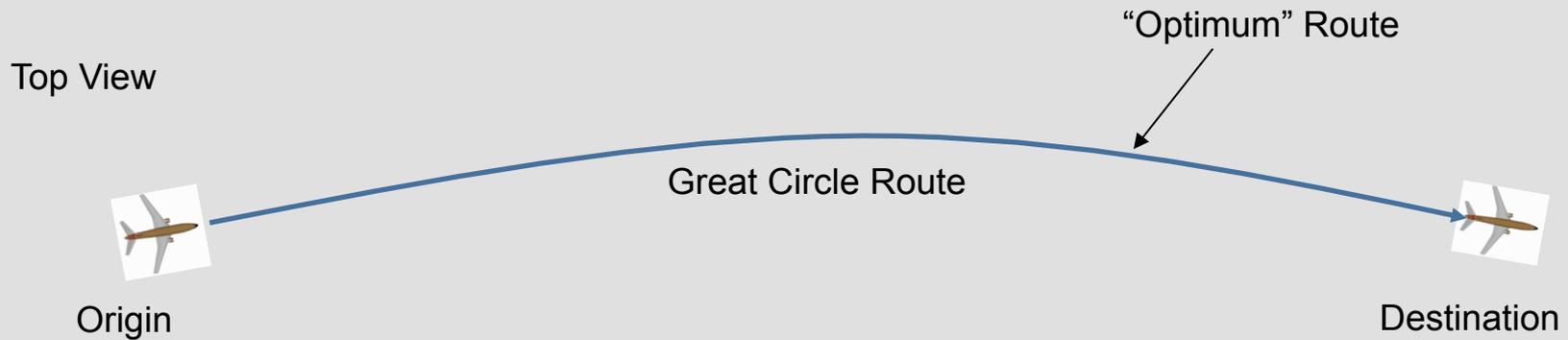
Oceanic Operating Environment

The airspace is procedural, largely structured and not flexible

Current Track Structure



Theoretical Approach



ADS-B Enables Flight Preferences



Flexibility – Better deal with the unexpected

Predictability – Operate to your plan in a dynamic environment



Wind and Schedule

Successful experiences will drive change toward achieving potential benefits



Surveillance Benefits

- Safety
- Predictability and Flexibility
- Environment/Efficiency

Space-Based ADS-B Benefits Assessment

- TAAM – fast time simulation tool
- June 2012 OTS traffic, adjusted for expected fleet changes
 - retired B747-400s
 - replaced some B767s with 787s
- Used a 1 degree by 1 degree wind cell model based on wind forecasts from the National Oceanic and Atmospheric Administration (NOAA)
- 2018: all aircraft Data Link capable and 90% ADS-B
- Fuel computed for Oceanic airspace only, although benefits could accrue beyond.

Base Case Scenario

Determine the 2018 (1st year) fuel burn:

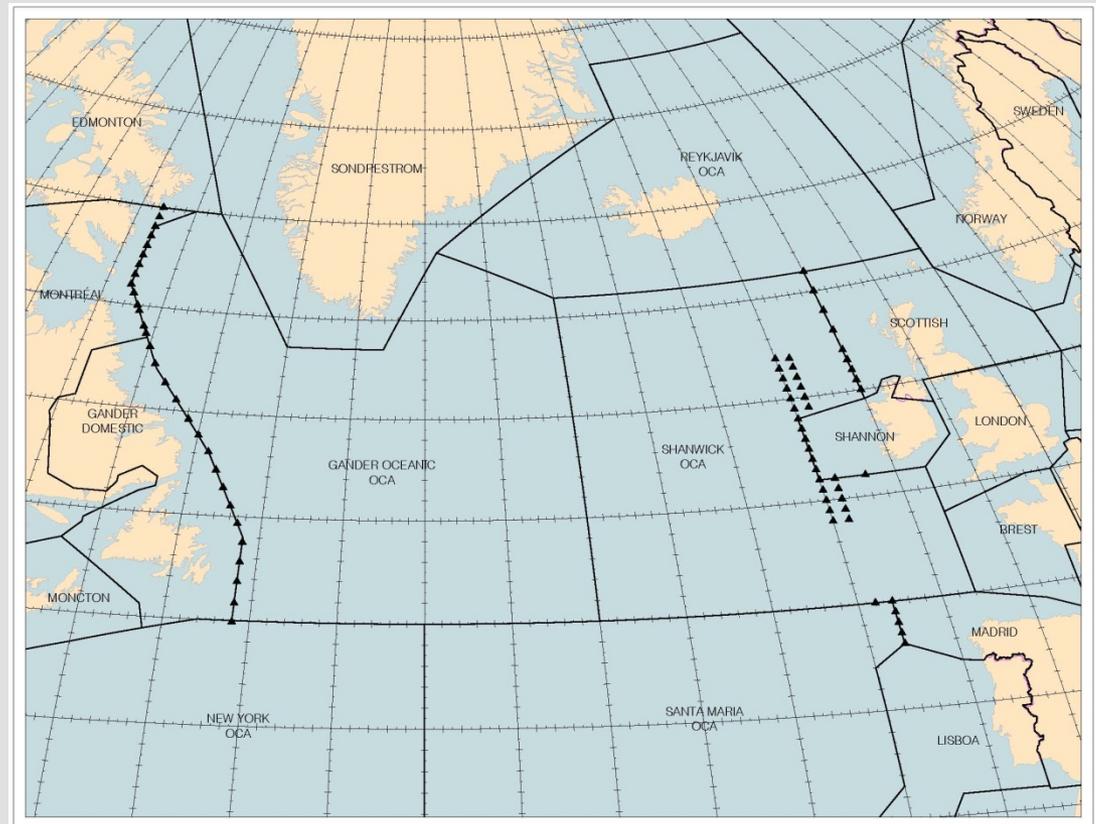
Base Case with RLongSM
& RLatSM

Sample Days:

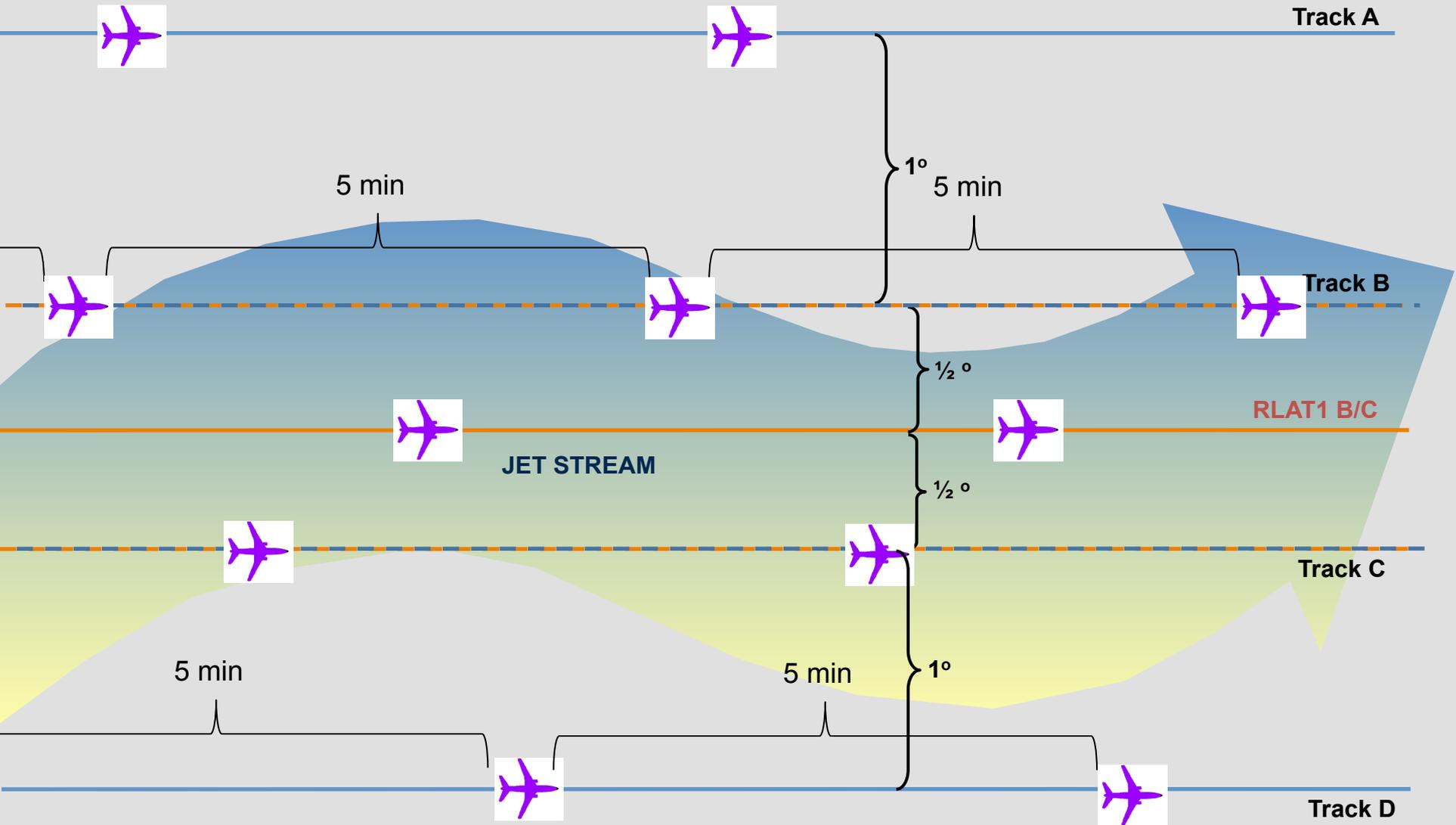
Eastbound June 12, 2012

Westbound June 18, 2012

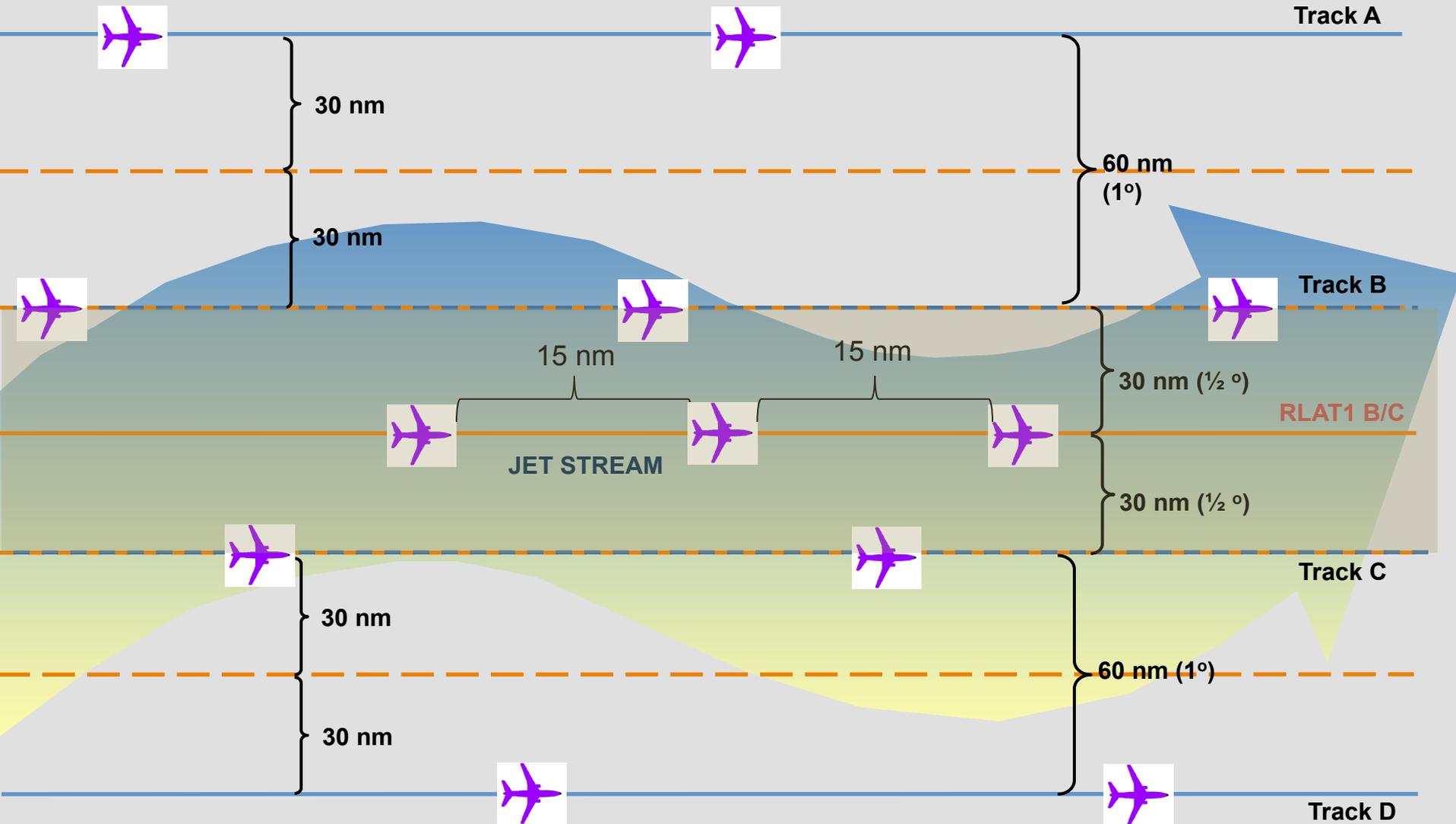
Included peak OTS 4 hour
plus the subsequent 4
hours when the traffic
flows in both East and
Westbound



Base Case: RLatSM1 and RLongSM

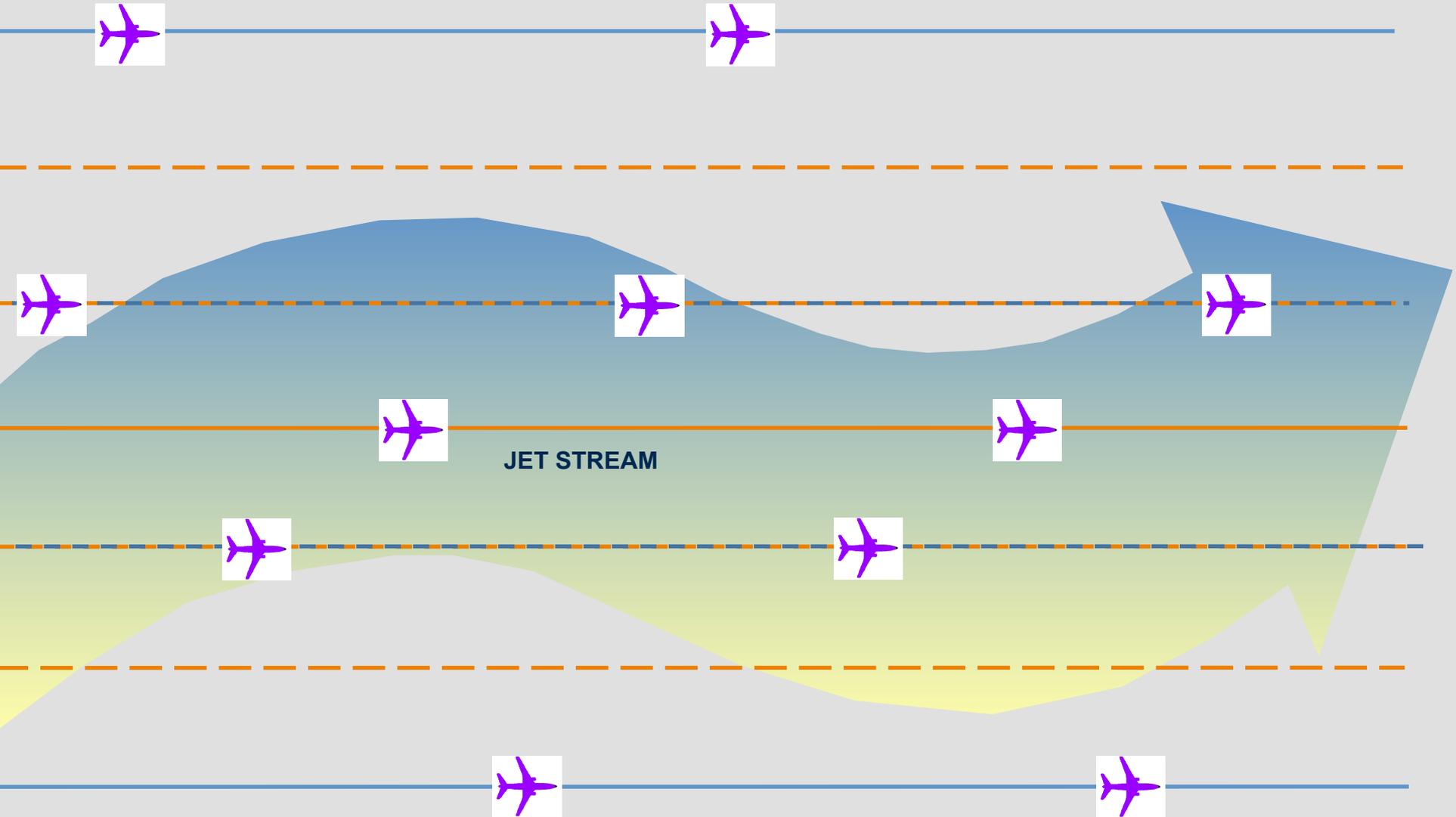


Option: Space-Based ADS-B



Space-Based ADS-B: a) More Efficient Routes

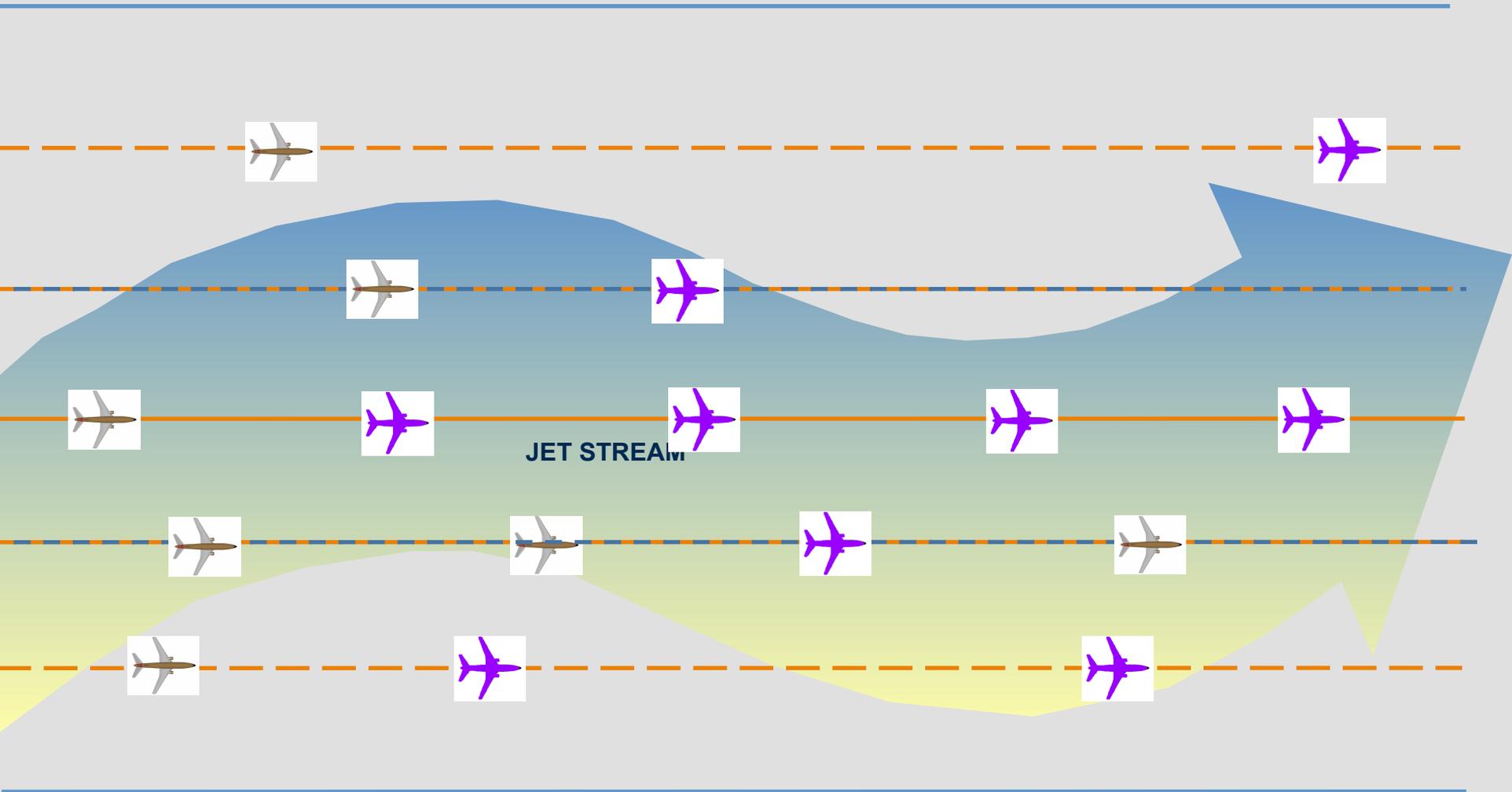
 ADS-B Aircraft



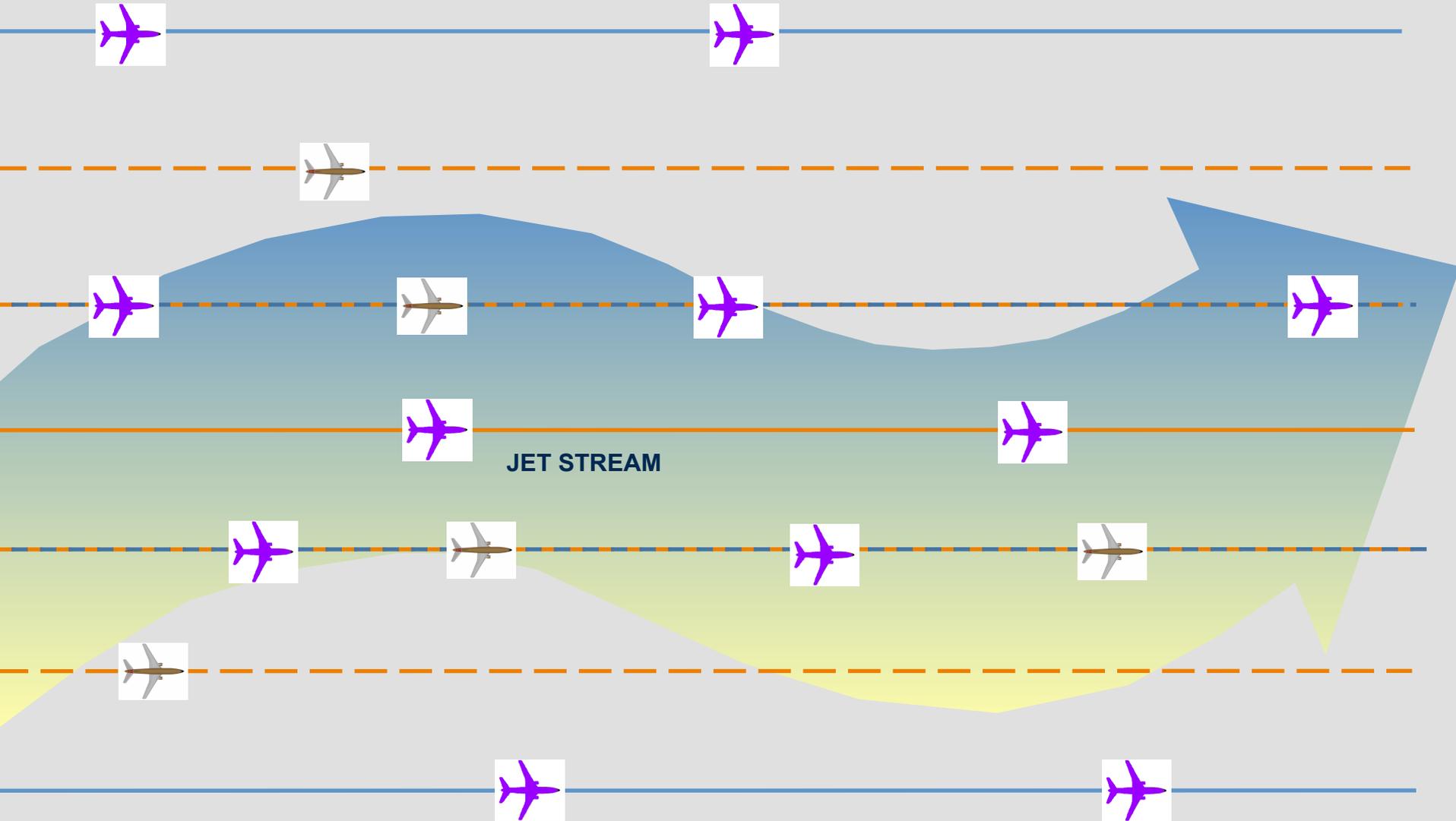
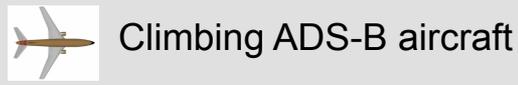
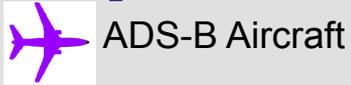
Space-Based ADS-B: b) More Climbs



Climbing ADS-B aircraft



Space-Based ADS-B: a & b) Combined



Gander-Shanwick Benefits

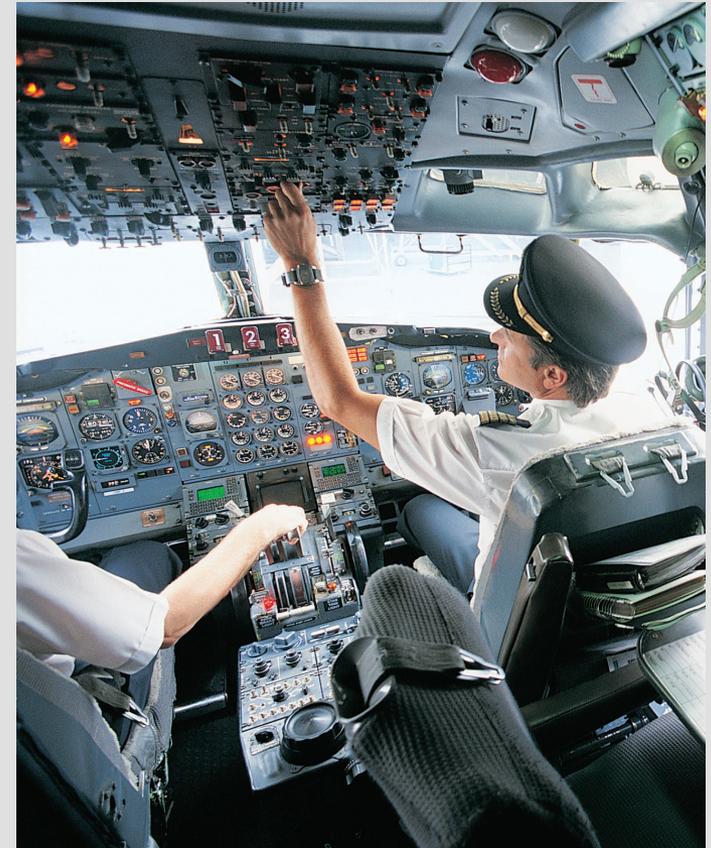
- An average fuel savings of 450 litres (855 pounds) was estimated per NAT flight
- Consistent with IATA members' savings from the variable speed/Flight Level ENGAGE project
- Represents less than 2% of the ocean portion of fuel for a transatlantic ADS-B flight (450/26,000 litres)

Space-Based ADS-B Annual Benefits

- The average fuel savings of 450 litres per flight was extended to all ADS-B eligible flights operating in Gander-Shanwick Airspace
- 282,000 ADS-B flights x \$450/flight = \$127 Million in 2018
- Year one benefits estimated at \$127 million CAD for 2018

Value for Airlines

- **Enhanced Safety**
by eliminating service gaps over areas with limited infrastructure or coverage
- **Billions in Fuel Savings**
by being allowed to climb to more optimal altitudes and use more efficient routes
- **Return on ADS-B Investment**
with no additional aircraft equipage costs required
- **Operational Efficiencies**
including optimized flight paths, altitudes, airspeeds and jet stream use
- **Reduced Emissions**
through fuel consumption optimization, a key benefit in a potential cap and trade world
- **Global Harmonization**
of different next-generation ATM operating procedures and systems





Thank you

SERVING A WORLD IN MOTION

